REMARKS

Applicant concurrently files herewith a Petition and fee for a Two-month Extension of Time.

Claims 1-20 are all the claims presently pending in the application. Claims 1, 9 and 12 are independent.

Attached hereto is a marked-up version of the changes made to the claims by the current Amendment. The attached page is captioned "**Version with markings to show changes made.**" These amendments are made only to more particularly point out the invention for the Examiner and not for narrowing the scope of the claims or for any reason related to a statutory requirement for patentability.

Applicant also notes that, notwithstanding any claim amendments herein or later during prosecution, that Applicant's intent is to encompass equivalents of all claim elements.

Claims 1-2 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoneta, et al. (U.S. Patent No. 5,574,345), in view of Kawashima (U.S. Patent No. 6,184,640).

This rejection is respectfully traversed in view of the following discussion.

I. THE CLAIMED INVENTION

The claimed invention is directed to a power supply for a magnetic bearing controller. The power supply includes a regenerative circuit for providing power from a motor to the magnetic bearing controller, an over-speed detector that generates an over-speed signal when the speed of the motor is greater than or equal to a predetermined speed, and a switch that switches the motor from an inverter in a motor controller to the regenerative circuit in response to the over-speed signal.

Conventional devices have included a magnetic bearing control unit to control the magnetic bearings and an inverter for driving the motor independently of each other. However, these conventional devices have been subject to many problems. For example, the rotor of the motor may be damaged if the speed exceeds a maximum. Further, an over-current may be supplied by the inverter to the motor which may cause the windings to burn or to break as a result of thermal stresses.

Some conventional devices include a malfunction detection device which may shut down the supply of power from the inverter to the motor. Alternatively, the malfunction detection device may control the inverter to act as a brake to stop the motor.

However, when the inverter itself loses control or becomes damaged, these devices are not capable of preventing damage to the motor. In such an instance, the magnetic bearing control is incapable of slowing or stopping operation of the motor and cannot prevent damage due to excessive speed and/or over-current.

By contrast, the present invention includes a regenerative circuit which provides the ability to slow down and stop the motor even when the inverter loses control or is damaged.

Additionally, the present invention provides a switch that switches the motor from an inverter in a motor controller to the regenerative circuit, to thereby bypass a damaged or malfunctioning inverter and to connect the motor with the regenerative circuit to slow down and stop the motor.

Further, even when the inverter malfunctions or is damaged, the regenerative circuit not only provides the ability to slow down and stop the motor, but also provides a source of power for the magnetic bearing control. In contrast to the conventional device and the situation when the power supplied to the conventional device fails or becomes too noisy, the present invention provides a regenerative device so that power is supplied to the magnetic bearing control even in the absence of an external source of reliable power.

II. THE PRIOR ART REFERENCES

The Examiner alleges that the Kawashima reference would have been combined with the Yoneta et al. reference to form the claimed invention. Applicants submit, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Firstly, Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, the references are directed to different matters. Specifically, the Yoneta et al. reference is directed to providing a source of power for a magnetic bearing system when the commercially available power fails and to simplifying such a circuit by not providing a power failure detection circuit and a switch circuit (col. 2, lines 51-52). In contrast, the

Kawashima reference is specifically directed to shutting off power to a motor controller when the motor exceeds a predetermined speed which is measured by a novel motor speed detection mechanism which has a simple structure and to continue to provide such commercially available power to a magnetic bearing system (col. 2, lines 18-19). Clearly, these objectives are at odds with each other.

More particularly, the Yoneta et al. reference is concerned with reliably maintaining power to a magnetic bearing system when the commercially available power supply fails without using a power failure detection circuit and a switch circuit to reduce the complexity of such a system (col. 1, line 16 - col. 2, line 44). In order to properly operate, the power supply disclosed by the Yoneta et al. reference requires that upon power supply failure, the motor 25 continues rotating, due to rotational inertia, and to supply regenerative electric power to the inverter 4, which provides the regenerative power to a DC/DC converter 10 which, in turn, provides the power to the magnetic bearing system (col. 4, lines 25-54). Thus, the magnetic bearing system is backed up by the regenerative electric power which flows through the inverter 4.

By contrast, the Kawashima reference is directed to interrupting the supply of commercially available power to the motor controller (col. 4, lines 22-25) when the speed of the motor exceeds a predetermined speed as measured by a speed detector. Indeed, the Kawashima reference teaches away from using an inverter to supply regenerative power to a magnetic bearing controller as taught by the Yoneta et al. reference. To the contrary, the Kawashima reference specifically teaches maintaining the connection from the commercially available power supply with the magnetic bearing controller (col. 6, lines 55-64). Modification of the circuit disclosed in the Yoneta et al. reference in this manner would cause that device to fail because the device

disclosed in the Yoneta et al. reference is directed to preventing the supply of a failed conventional power supply to the magnetic bearing controller while the Kawashima reference is directed to continuing the supply of the conventional power supply to the magnetic bearing controller.

Additionally, the Yoneta et al. reference is specifically directed to avoiding the use of a switch (col. 2, lines 50-52) to simplify the power supply. Thus, Yoneta et al. reference specifically teaches away from the modification that the Examiner alleges. One of ordinary skill in the art would not have been motivated to modify the circuit disclosed in the Yoneta et al. reference with the switch disclosed in the Kawashima reference because the Yoneta et al. reference specifically teaches away from providing a switch.

Clearly, one of ordinary skill in the art would not have been motivated to modify the Yoneta et al. reference with the teachings of the Kawashima reference because, as explained above, these references are directed to completely different problems, provide mutually inconsistent solutions and such a modification would cause the device disclosed in the Yoneta et al. reference to fail to operate.

Secondly, even assuming arguendo, that one of ordinary skill in the art would have been motivated to combine these references, the combination would not teach or suggest each and every element of the claimed invention.

Contrary to the allegations of the Examiner, the Yoneta et al. reference does not teach or suggest a motor drive circuit which includes an inverter and a regenerative circuit. To the contrary, the Yoneta et al. reference repeatedly emphasizes that the inverter 4 acts as a regenerative circuit (see, for example, col. 3, lines 56 - 59 and col. 4, line 28).

Indeed, the Yoneta et al. reference is subject to the same problems of the conventional devices which are solved by the present invention. Conventional devices, just like the device described by the Yoneta et al. reference, are subject to damage as a result inverter failure. The present invention is capable of solving this problem and preventing damage resulting from inverter failure by providing a regenerative circuit in addition to the inverter in the motor controller). The Yoneta et al. reference is subject to these same problems which are solved by the present invention.

Additionally, contrary to the allegations of the Examiner, the Yoneta et al. reference does not teach or suggest a switch that switches the motor from an inverter in a motor controller to the regenerative circuit. To the contrary, the Yoneta et al. reference appears to disclose a switch 8 which is adapted to select DC voltage from an AC/DC regulator 7 (from the commercial power supply) during normal operation and to select DC voltage from DC/DC converter 10 (from the inverter 4) when the power failure detection circuit 11 detects a failure in the commercial power supply (col. 2, lines 4-7).

Moreover, as explained above, the Yoneta et al. reference teaches away from using any type of switch because an objective of that invention is to avoid complexity by omitting any type of switch (col. 2, lines 42-52).

The Examiner is also incorrect in alleging that the Yoneta et al. reference discloses connecting the regenerative circuit to the motor. As explained above, the Yoneta et al. reference does not teach or suggest any regenerative circuit at all, let alone connecting one to the motor. Indeed, the Yoneta et al. reference discloses that the inverter serves as a regenerative circuit and

nowhere within that reference is there any disclosure that the inverter is not connected to the motor such that it can be switched into such a connection. The connection is always present between the inverter 4 and the motor 25 in the system disclosed in the Yoneta et al. reference.

The Kawashima reference does not remedy the deficiencies of the Yoneta et al. reference. As explained above, the Kawashima reference discloses a RPM detection mechanism. The Kawashima reference is concerned with simplifying a DC brushless motor having an RPM detection mechanism with a simple structure (col. 2, lines 15-20). In particular, the Kawashima reference discloses using a hall sensor which detects the change in polarity by the permanent magnet to provide an RPM detection (col. 2, lines 36 - 44), and discloses using this mechanism as an over-speed detector. Kawashima sends an interrupt command to a power source breaker 54 to forcibly interrupt the supply of electric power to a motor drive circuit 51 (col. 4, lines 22-25).

Similar to the Yoneta et al. reference, the Kawashima reference does not teach or suggest a motor drive circuit which includes an inverter and a regenerative circuit. To the contrary, the Kawashima reference only discloses cutting off the power supply to a motor drive circuit 51 to stop the motor 30. The Kawashima reference does not teach or suggest anything about any type of regenerative circuit, let alone a regenerative circuit for supplying a regenerative power to a magnetic bearing drive controller.

Rather, the Kawashima reference discloses continuing the supply of power from the power source 53 to the magnetic bearing drive controller (col. 6, lines 55 - 64). Therefore, the Kawashima reference does not teach or suggest a regenerative circuit for supplying a regenerative power to a magnetic bearing drive controller.

Additionally, contrary to the allegations of the Examiner, the Kawashima reference does not teach or suggest a switch which separates an inverter from the motor. Rather, the Kawashima reference discloses disconnecting the power supply 53 from the motor drive circuit 51 and there is no mention anywhere within the Kawashima reference of separating the inverter 51 from the motor 30. In the event of an over-speed condition, the Kawashima reference relies upon the ability of the motor drive circuit 51 to stop the motor controllably (col. 8, lines 37-40) and in the event that the motor drive circuit 51 fails, the interruption of power stops the motor (col. 8, lines 48 - 51). Thus, claims 1-2 are patentable over the cited references.

Therefore, the Examiner is respectfully requested to withdraw this rejection.

III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing amendments and remarks, Applicant respectfully submits that claims 1-20, all the claims presently pending in the Application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the Application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 1/24/02

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